

Working Draft for TOC Review and Revision

July 24, 2003 Meeting of the TOC

To: Superintendent, Everglades National Park
Manager, A.R.M. Loxahatchee National Wildlife Refuge
District Engineer, Jacksonville District, Army Corps of Engineers
Secretary, Florida Department of Environmental Protection
Executive Director, South Florida Water Management District

From: TOC representative, South Florida Water Management District
TOC representative, Florida Department of Environmental Protection
TOC representative, Everglades National Park
TOC representative, A.R.M. Loxahatchee National Wildlife Refuge
TOC representative, Jacksonville District, Army Corps of Engineers

Re: Exceedences of the Interim Phosphorus Levels for A.R.M. Loxahatchee National Wildlife Refuge under the Settlement Agreement (1991, Case No. 88-1886-Civ-HOEVELER)

Background: The Technical Oversight Committee (TOC) requested a letter report evaluating the July 2002 exceedance from the total phosphorus (TP) Interim Levels for the Arthur R. Marshall Loxahatchee Wildlife Refuge (Refuge) as set forth in the Settlement Agreement (1991, Case No. 88-1886-CIV-HOEVELER). The letter would be sent as a consensus document to the Principles of the Consent Decree as had been done twice before during the period since 1999 when the Interim Levels went into effect.

The District responded to this request by summarizing key facts relevant to determining whether the July exceedance was due to “error or extraordinary natural phenomena” or represents a violation of the Settlement Agreement’s Interim Level. A draft letter report from the District was provided to the TOC its June 3, 2003 meeting (Attachment 1). The Federal parties to the Settlement Agreement responded independently to the TOC’s request with a more extensive study of the phosphorus levels in the Refuge since 1999 emphasizing the role of external loading. They provided a draft letter and an oral presentation to the TOC at the June meeting. A written report authored by consultants to the Department of the Interior was provided documenting the analyses and recommendations made orally at the June meeting (see attachment 2).

This letter report represents a consensus of opinions and recommendations from TOC representatives of parties to the Settlement Agreement and melds these

different interpretations of Refuge phosphorus levels into one document. It summarizes circumstances of the July exceedance while also providing a longer-term evaluation of phosphorus levels and exceedances in the Refuge.

Settlement Agreement Interim Levels and Compliance Procedures.

Appendix B to the Settlement Agreement specifies that “[a]n exceedance [of Loxahatchee’s interim levels occurs if the 14 station mean concentration is greater than the computed concentration level two or more times in any 12 consecutive sample collections.” Appendix B further provides that “[a]n exceedance will constitute a violation of this Agreement and relevant water quality criteria unless the TOC determines there is substantial evidence that it is due to error or extraordinary natural phenomena.”

To make a determination based on substantial evidence, exceedances of the Interim Levels are reviewed by the TOC as a potential violation of the Settlement Agreement. With information from this review and recommendations from TOC members, the TOC Principals of the five settling parties will then decide what actions may be appropriate under the Settlement Agreement. This letter report to the Principals is the mutual vehicle for communicating TOC’s determination concerning the July exceedance. Should TOC determine that the Interim Levels are not being met, DEP may require that additional phosphorus control measures to ensure that a maxim annual discharge limit of 50 ppb is met for all discharges to the Refuge. If the discharge limit is being met, the Settlement Agreement does not require any additional measures during the interim period ending on December 31, 2006.

Federal and State Perspectives on Refuge Exceedances

The following represents a comparative summary of interpretations of 1999 to 2003 data in relation to the exceedances of the Interim Levels. The summary is based upon District analyses (Attachment 1), those conducted for the Department of the Interior (Attachment 2), and subsequent deliberations at the TOC meetings. Unless cited otherwise, quotes for DOI are from Walker and Kadlec in Attachment 2).

Key Points from the State Agencies

1. State Assertion (see Attachment 1): Exceedances occur in a regular pattern associated with rapid changes in stage. The cause of the exceedances is not fully understood but is likely a combination of resilience of P concentrations as stages rise rapidly following dry periods with low stage levels, equation under-predicting P levels as stages rise rapidly and external loading to the Refuge, at least over the long-term.

The Federal Representatives agree on the association with stage (page 7, #1, Attachment 2), but not on the cause. They agree that the pattern of exceedances associated with sharp increases in stage has been seen

repeatedly in the Refuge since 1999. However, they see this association as one generated by the inexorable link between stage increase and loading dynamics, and feel that external loading is more important than stage effects.

All parties agree that there is no evidence of any field, laboratory or computational error involved in these exceedances. There is no direct evidence that the compliance equation under-predicts during periods to rapidly changing stage, but most exceedances do occur under this specific kind of circumstance.

2. State Assertion: There is no information available demonstrating that external loading is influencing Refuge nutrient climate substantially, nor that loading is directly responsible to the post February 1999 exceedances.

The Federal representatives disagree. They see the P gradient from the rim canal, the exceedances themselves, conservative tracer analysis of water movement and P loading dynamics in combination as evidence of anthropogenic enrichment and potential imbalances of flora and fauna.

The State parties concur that the rim canal P gradient information is undoubtedly real, but because it existed long before the Settlement Agreement was signed, it can not be used to document recent nutrient inputs nor those actually reaching the monitoring stations. In addition, even if P transport across the marsh occurs to some extent over long time scales, there is no requirement in the Settlement Agreement to keep water from flowing into the marsh. The Agreement is targeted at controlling inputs and tracking compliance with limits and levels. The conservative tracer analysis does suggest that water can gradually move across the marsh from the rim canal, but the State parties remain unconvinced that there is evidence of an ecologically significant movement of P into the interior marsh. On the contrary, there is ample data showing that P concentrations at individual stations and groups of stations are declining since 1999 (Attachment 1).

3. State Assertion: While exceedances do tend to occur early in P loading events (page 7, #2), they do not follow a pattern consistent with the Federal hypothesis of sole causation by the loading event. For example, even periods with loading extending over several months, are not accompanied by repeated excursions (Attachment 2, Figures 7 and 8,). State parties know of no explanation for this pattern if loading is generating the exceedances. In addition, exceedances occur more frequently for sites located away from the canal making very difficult to tie recent loading to the exceedances (Attachment 1, Figure 3). Finally, stations near the rim canal not only show lower exceedance frequencies, but do not show higher phosphorus levels than interior sites (Attachment 1, Figure 4,).

As considered in greater depth in the DOI Assertions below, the Federal representatives do not agree that these inconsistencies are important.

They remain convinced that external loading is a primary causative factor in exceedances of the Interim Limit and that the State observations simply reflect the temporal and spatial complexity of the Refuge in responding to external p loading.

Key Points from the Federal Perspective

1. DOI Assertion: “Exceedances have occurred during periods of high phosphorus loads, increasing stage and hydraulic gradients sloping from the exterior rim canal towards the marsh. These conditions are conducive to transporting phosphorus to the marsh.”

The State agrees. Exceedances form a very consistent pattern corresponding to rapid changes in stage, external inputs and hydraulic gradients potentially allowing canal water to enter the marsh.

2. DOI Assertion: Compliance during the recent months is not a reliable indicator of current marsh status

The State does not agree wholly. There has been no evidence provided of a fundamental change in marsh status of the Refuge or convincing data that the monthly geomeans do not reflect the nutrient status of the Refuge. The excellent QA of these data, their 14 station distribution across the marsh and the 12 monthly measurements each year has created an outstanding data set reflecting the nutrient status of the marsh. Further, there is no data known to the State showing that phosphorus levels have increased in the Refuge since compliance tracking started in February 1999. In fact, there is a general downward trend for the 14 station geomean and at all individual sites from 1999 to the present. This trend must be viewed cautiously, however, because longer term hydrological cycles could generate short trends.

3. DOI Assertion: Decisions should be based on the cumulative record and trends not upon a highly variable monthly signal.

The State agrees with some qualification. Previous exceedances were assessed by TOC using proximal data with concurrence by Federal parties to the Settlement Agreement. Data from individual dates can be very informative, particularly those collected when conditions are changing.

4. DOI Assertion: “There has been no demonstration that errors occurred or that the exceedances were caused by extraordinary natural phenomenon.”

The State does not agree while noting that the Settlement Agreement does not define ‘error or extraordinary natural phenomenon’ making any such demonstration vulnerable to a very broad interpretation.

The State submits that the exceedances reflect a combination of poorly understood factors in Refuge biogeochemistry, idiosyncratic behavior of the compliance equation under select conditions of rapid change in stage,

and over the long-term, external phosphorus loading. Given the available data on the Refuge and imprecise definitions, it is unlikely that TOC will agree that these factors, individually or collectively, can be raised to the level of affirming an 'error or extraordinary natural phenomenon' or that external loading is an important contributing factor. However, it is far more important that there is no substantial evidence that external loading has had demonstrable effect on recent marsh phosphorus levels or on the frequency of exceedances despite the substantial effort reflected in the DOI report in Attachment 2. In fact as mentioned above, examination of the data of interior marsh sites reveals frequent exceedances that are inconsistent with the scenario that external loading is a significant contributing factor.

5. DOI: Correlations using monthly water quality data are subject to high temporal and spatial variability and it is unrealistic to expect clear spatial patterns or correlations.

The State agrees in part while reinforcing that there can be highly valuable observations made for data from individual months across individual stations or station groups. The value of correlations should be assessed on a case by case basis. Also, often the absence of an expected correlation is more informative than the presence of an unexpected one.

6. DOI: "Elevated concentrations of conservative substances establish the fact that water from the exterior rim canal containing high concentrations of phosphorus penetrates at least as far as the outer ring (ca.50%) of marsh stations."

The State agrees that conservative tracers suggest movement into substantial areas of the Refuge at least over the long-term. However, looking closely at conservative tracer data reveals large variability with no distinct correspondence with phosphorus levels even for stations near the rim canal. This lack of association makes interpretation of phosphorus delivery to the interior marsh extremely tenuous and essentially not predictable based on conservative traces like conductivity, sodium or chloride.

7. DOI: Exceedances of marsh P levels and overall phosphorus mass balances on the Refuge are strong indicators that phosphorus continues to accumulate in the marsh vegetation and soils.

The State agrees that the phosphorus mass balances and patterns in soil levels indicate that the Refuge is behaving exactly as would be predicted for any wetland system. The State also agrees that P does accumulate in Refuge vegetation and soils as it has done for decades. The some P accumulation is a given and does not constitute a link between recent P loading to the exceedances.

The phosphorus control programs of the Settlement Agreement are based fundamentally on the finding that the Refuge marsh has some connectivity to the rim canal and is subject to continuing nutrient-derived imbalances if phosphorus levels are not reduced as specified in the Agreement. Furthermore, the monitoring and compliance system in the Settlement Agreement does not assume that no phosphorus would be delivered to the interior marsh. The Settlement Agreement seeks substantial reductions in P below the baseline and that the P limits and levels are met.

8. DOI: “An immediate focus on the Refuge is recommended to provide assurance that interim and long-term marsh phosphorus levels will be achieved on schedule. The fact that compliance with interim P levels improved after full-scale STA operation suggests that it will continue to improve if loads are further reduced.”

The State agrees wholeheartedly and emphatically. We urge continued Federal cooperation to expedite the completion of STA 1E and implement enhancements to STA-based P controls outlined in the Conceptual Plan.

Longer Term Context of TP Inputs to the Refuge: Major changes in TP loading and inflow concentrations to the Refuge have been documented with STA-1W and STA-2 in full flow-through operations. The concentration values in **Table 2** show the major effect that STA treatment has on TP levels; untreated STA inflow water via G302 recorded TP levels far above the 30 – 40 ppb commonly seen in treated STA-1W inflows to the Refuge via G 251 and 310. More reductions can be expected with the completion and full operation of STA-1 East and the additional enhancements to STA-1W contemplated in the Conceptual Plan. When all sources of water entering the Refuge during Water Year 2002 are combined, they have a median concentration of 38 ppb, about one-half the value observed for the 1978-2000 base period (Chapter 2, 2003, Everglades Consolidated Report).

Working in tandem with STA treatment, the EAA BMP Program has resulted in significant reductions in TP loading derived from the Everglades Agricultural Area. Data summarized in Chapter 3 of the 2003 Everglades Consolidated Report documents that EAA phosphorus loads have been reduced 55 % for Water Year 2002, compared to what would have entered the WCAs under similar rainfall periods prior to BMP implementation. Prior to the STAs and the EAA BMPs, approximately 90-100 metric tons TP per year entered the Refuge from the EAA. During normal flow years, implementation of EAA BMPs, and the effectiveness of STA-1W and STA-2 should reduce phosphorus loads from the EAA to the Refuge by about 85%, meeting the load reduction goals contemplated in the Settlement Agreement. In addition, STA-1 East will bring additional water into the Everglades system (via the Refuge) for hydropattern restoration.

It is critical that the programs set in motion by the Settlement Agreement be completed, particularly STA 1E. In addition, the enhancements to phosphorus

controls contemplated in the Conceptual Plan must be implemented as the highest priority for State and Federal agencies.

Conclusions:

All Federal and State TOC representatives agree that:

1. The exceedances reflect a combination of poorly understood factors in Refuge biogeochemistry, behavior of the compliance equation under select conditions of rapid change in stage, and external phosphorus loading, particularly over the long term and during rare, major loading events.
2. There are signs of improvement in the Refuge associated with phosphorus controls initiated under the Settlement Agreement. Both loads and loading spikes have been reduced. For the last eight months TP levels have not only achieved interim levels but bettered the long-term levels not scheduled to go into effect until December 2006. The Refuge is presently in compliance with the Interim Levels of the Settlement Agreement. Given the TP levels in the Refuge, the hydrological circumstances discussed above (which are analogous to circumstances associated with the rapid rise in water levels seen in 1999, 2000 and 2001), the July 2002 TP exceedance is not indicative of any fundamental change in the phosphorus status of the Refuge with significance to the Interim Levels of the Settlement Agreement.
3. The uncertainties, environmental complexities and honest differences of scientific interpretation reflected in this letter and its attachments can not be resolved with the correlative information available for the Refuge. Little improvement in our predictive understanding of the exceedances is expected even with a substantial additional effort.
4. The programs of the Settlement Agreement need time for completion and optimization, and State/Federal efforts are best directed at these important actions, not on continuing deliberation over data and interpretation.
5. Therefore, the TOC concludes that the exceedances resulted from a suite of overlapping factors and should be viewed as a signal for redoubling State and Federal efforts to control phosphorus and develop better management strategies the marshes of the Refuge. The recommendations that follow reflect this overall conclusion.

Recommended Actions: No corrective actions are required by the Settlement Agreement or recommended by the TOC at this time to address recent exceedances specifically. Appendix B of the Settlement Agreement contemplates potential correction measures in the event the Interim or Long-Term TP Levels are not met in the Refuge. Long-term TP Levels do not go into effect until January 1, 2007. With regard to exceedances of Interim TP Levels, Appendix B (Page B-2) directs only that DEP implement control measures "to meet a

maximum annual discharge limitation of 50 ppb for all discharges into the Refuge from the EAA.” Outflows from STA-1W during the relevant time period averaged below 50 ppb and the Refuge, consistent with the Walker load reduction methodology, had met its load reduction goals for the period relevant to the exceedances.

However, for the long-term benefit of the Refuge, the TOC representatives recommend the following actions for consideration by the Principals to facilitate progress on phosphorus control, analysis and tracking for the Refuge relative to requirements of the Settlement Agreement:

1. Expedite the completion and optimization of Stormwater Treatment Areas treating waters discharged to the Refuge with the following measures:
 - a. Request Federal Task Force expedite the completion of STA 1E and its enhancements described in the Conceptual Plan.
 - b. Request the District provide all resources needed to implement structural enhancements and vegetation management actions to optimize STA 1W as described in the Conceptual Plan as an urgent budgetary priority. This effort should include improvements to the monitoring of flow, phosphorus concentrations and water level in STA 1W and the updating and calibration of DMSTA for this treatment area.
 - c. Continue to develop and implement operational strategies to operate STA 1W within its design range. Ensure that the recent overloading of this STA is studied as a means of improving our predictive understanding of STA performance.
 - d. Request that the USACE undertake a process to clarify of the WSE operating criteria to minimize diverting water to the Refuge unnecessarily and overloading STA 1W.
 - e. Request RECOVER and the Interagency Modeling Center to initiate technical analysis and water quality modeling of L40 canal capacity and marsh inflows in relation to projected discharges of STA 1E. This request may include continued development of a water quality / hydraulic model for the Refuge with a phosphorus cycling component to allow prediction of P levels across the marsh.
2. Expand Federal and State collaboration to conduct detailed technical analyses to summarize and predict the relationships between discharges and water quality in the Refuge.
 - a. This project would be an enhancement of that being initiated under the Conceptual Plan to fulfill the requirements of the EFA to define relationships between discharges to and water quality within the Everglades Protection Area. Enhancement of this project may include a P mass balance model for the Refuge and further evaluation of potential causal factors for Refuge exceedances.

Distribution List for Electronic and Paper Copies

Principals of the Consent Decree

- Ernie Barnett, Director of Ecosystem Projects, Florida Department of Environmental Protection;
- Henry Dean, Executive Director, South Florida Water Management District
- Colonel James May, U.S. Army Corps of Engineers, Jacksonville
- Mark Musaus, Manager, ARM Loxahatchee National Wildlife Refuge
- Maureen Finnerty, Superintendent, Everglades National Park

TOC Representatives

- Garth Redfield, SFWMD
- Frank Nearhoof, FDEP
- William Baxter, USACOE
- Michael Waldon, USFWS
- Nicholas Aumen, NPS

Other Interested Parties

All persons on the TOC electronic mailing list as of June 4, 2003 were provided with an electronic file of this letter and were notified of its posting on the TOC website: <http://www.sfwmd.gov/org/ema/toc/index.html>.

CC Paper Copies:

Carrie Trutwin
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Chip Merriam

Attachment 1.

A. District Evaluation of the Proximal Circumstances Contributing to the July 2002 Exceedance

District Evaluation of the July TP Exceedance: Marsh geomeans have exceeded the Interim Levels one or more times in each year since the interim levels went into effect in February 1999, most recently between in July and October 2002. Knowing that these instances are often associated with sharp changes in stage, the District's analysis focused on inflows and stage dynamics.

A rapid rise in Refuge stage due to inflows and local rainfall resulted in a geometric mean TP concentration for July 2002 of 11.2 ppb which is 1.5 ppb higher than the calculated Interim Level of 9.7 ppb. The 'Interim TP Level' for the Refuge became effective February 1, 1999. The Interim Level for TP was first exceeded within the 12-month period in October 2001. A second exceedance in the 12-month period occurred in July 2002. This letter concerns the second exceedance. Evaluations of two earlier exceedances were the subject of two letters to the Principals dated July 14, 2000 and October 24, 2001. Based upon their analysis of the data and relevant circumstances, TOC recommended no actions on these exceedances.

Geometric mean concentrations of TP, applicable TP limits, and water depths (stages) in the Refuge for the January 2001 through December 2002 period are presented in the April, 2003 Quarterly Water Quality Conditions Report, posted on the TOC website: <http://www.sfwmd.gov/org/ema/toc/index.html>. An updated version of these data through March 2003 for the Refuge is provided in the attached **Table 1**. TOC members and interested parties were provided with water quality information, including data on the July 2002 and October 2001 exceedances, in quarterly reports to the TOC for the February and June 2003 meetings. The time lag between data collection and evaluation by the TOC normally runs 6 to 9 months due to typical field collection, laboratory analyses, quality control and data reporting times. The District is currently in the process of implementing a new system of reporting that will shorten this lag time substantially and provide updated data on the TOC website on a monthly basis.

The July 2002 excursion is summarized below in the table below:

Month 2002	Geometric Mean (ppb TP)	Interim Level (ppb TP)	Long-Term Level * (ppb TP)	Average Stage (ft.)
July	11.2	9.7	8.3	16.82

* Note that the Long-Term Level becomes effective December 31, 2006.

Contributing Circumstances: Discussion at the February 2003 TOC meeting and subsequent evaluation of Refuge monitoring data by District staff revealed proximal circumstances that should be considered when interpreting these data and deciding upon appropriate recommendations to the Settling Parties. Hydrological and nutrient conditions during June and July, 2002 are particularly important to consider.

Data on daily stage levels, inflow volumes, rainfall amounts, TP loads, and TP concentrations are provided in **Table 2**. The location of inflow points in the Refuge is given in the attached Figure 1 and the location of monitoring sites is shown on Figure 1 of each Settlement Agreement report to the TOC.

Based on data from S5A, over 17 inches of rain fell in June 2002 and the first half of July 2002 prior to Refuge sampling on July 15 and 16, 2003. This significant local rainfall was part of a pattern of very heavy rainfall in the central and northern sections of the District. The July 11, 2002 Water Conditions Summary to the Governing Board noted that rainfall in June and the first one-half of July was over 1.5 times normal and produced rapid increases in water levels in Lake Okeechobee and the Water Conservation Areas. This regional and local water input resulted in increased inflows to the Refuge in mid-June, and combined with direct rainfall, raised water stages in the Refuge from an average of 15.04 ft. in May to 16.82 ft. in July 2003 (**Table 1**). It is important to note that both the July 2002 and October 2001 events occurred during periods when water levels increased rapidly after a period of low water levels. In fact, since the Interim Level went into effective in February 1999, 6 of 7 exceedances were associated with increases in stage from the previous month of 0.5 to 1.3 feet. This pattern does not appear to be random, and suggests that marsh TP levels do not respond as quickly to the dilution effects of increasing stage as is predicted by the equation used to calculate the Interim Level.

The data in **Table 2** also show phosphorus concentrations entering the Refuge during the June to July 2002 period of increasing inflows. For a brief period from June 21 to 27, 2002, G300 and G301 discharged relatively small volumes of untreated water into the L7 and L40 canals in the Refuge. From mid-June to mid-July, G302 contributed high TP concentrations and flows to STA-1W. Inflows to the Refuge from STA 1W through G251 and G310 showed much lower phosphorus concentrations after treatment by the STA and contributed substantial volumes particularly during the period from June 18 to July 16, 2002. The STA-1W inflow concentrations during this same period are consistent with the annual mean for WY 2002 of 38 ppb (2003 Everglades Consolidated Report, Chapter 4A). Inflows to the Refuge from the ACME basins were rich in phosphorus but flow amounts were much smaller than other inflows.

It is also informative to examine monthly data from the 14 individual stations in the Refuge (see **Table 3**) for the period between January 2001 and December 2002. Six stations showed increased TP levels in July 2002 after experiencing

very low water levels in the May to June 2002 period (LOX 3, 4, 5, 9, 10, and 11). This tendency was counterbalanced by 5 stations that experienced low water levels in the May-June timeframe and showed a decreased phosphorus concentration in July relative to June (LOX 6, 7, 8, 13 and 16). Considering the changes at all these stations and the inconsistent pattern seen in the three stations that did not dry out (LOX 12, 14 and 15), we see no obvious pattern of concentration change in Refuge sampling stations associated with proximity to the canal and inflowing nutrients, with the possible exception of LOX 4 (Table 3). Therefore, variation in TP levels due to short-term, natural hydrological and stage dynamics appears to be the primary source of the July 2002 TP exceedance.

Table 1. Loxahatchee National Wildlife Refuge Total Phosphorus Compliance Tracking (updated from April, 2003 report with data through March, 2003).

Month - Year	Geometric Mean Concentration	Interim Level (ppb)	Long Term Level (ppb)	Average Stage	Number of TP Samples	Number of Stage Measurements
	(ppb)	Effective 2/1/99	Effective 12/31/06	(ft,NGVD)		
Apr-2001	11.5	21.4	16.9	15.48	6	3
May-2001	18.3	0.0	0.0	14.88	2	3
Jun-2001	15.1	0.0	0.0	15.42	9	3
Jul-2001	11.4	17.2	13.8	15.82	11	3
Aug-2001	10.0	10.1	8.6	16.74	14	3
Sep-2001	9.6	11.1	9.3	16.57	14	3
Oct-2001	8.8	8.3	7.2	17.24	14	3
Nov-2001	6.6	8.3	7.2	17.46	14	3
Dec-2001	7.5	8.9	7.7	16.99	14	3
Jan-2002	6.4	10.4	8.8	16.69	14	3
Feb-2002	7.8	10.7	9.1	16.63	14	3
Mar-2002	7.3	11.5	9.7	16.50	14	3
Apr-2002	7.5	15.6	12.7	15.98	11	3
May-2002	10.0	0.0	0.0	15.04	3	3
Jun-2002	13.4	16.0	12.9	15.94	10	3
Jul-2002	11.2	9.7	8.3	16.82	14	3
Aug-2002	9.0	13.5	11.1	16.22	12	3
Sep-2002	8.2	10.6	8.9	16.66	12	3
Oct-2002	7.5	10.7	9.0	16.64	12	3
Nov-2002	6.9	10.5	8.9	16.66	12	3
Dec-2002	5.9	9.2	7.9	16.93	14	3
Jan-2003	5.7	10.0	8.5	16.76	13	3
Feb-2003	7.5	11.3	9.5	16.54	11	3
Mar-2003	8.0	13.4	11.0	16.23	9	3

Notes: (1) Average Stage is calculated using stage elevations at three stations on the sampling date
(2) Highlighted values indicate months when exceedances occurred

Figure 1. STA-1W Structures & Flow*

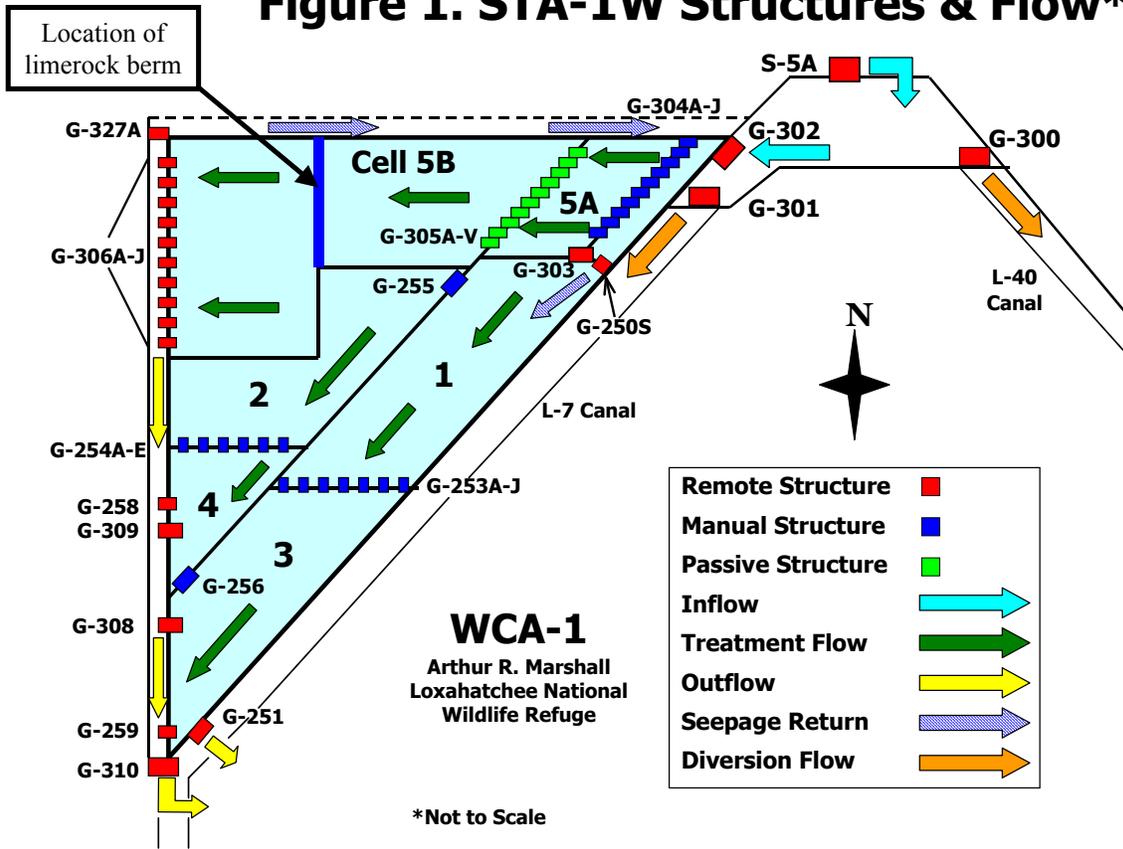


Figure 1. STA-1W Schematic

Tables 2 and 3 are attached as Excel files.

Attachment 1.

B. Factors Contributing to Exceedances of Interim
Phosphorus Levels in the Refuge - A presentation to TOC,
July 24, 2003

Attachment 2.

Compliance of Marsh Phosphorus Concentrations in the A.R.M. Loxahatchee National Wildlife Refuge with Interim Levels Required Under the Consent Decree

Prepared for the Department of the Interior by William W. Walker
and Robert H. Kadlec, and published on the TOC web site July 14,
2003.